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Private Freight Car System and
Special Equipment Cars

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PRIVATE FREIGHT CAR SYSTEM AND
SPECIAL EQUIPMENT CARS

BY

LOUIS DWIGHT HARVELL WELD, A. B. (BOWDOIN), '05

THESIS

FOR THE DEGREE OF MASTER OF ARTS
IN THE GRADUATE SCHOOL

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Louis Dwight Harvell Weld, A.B., Bowdoin College, 1905

ENTITLED THE PRIVATE FREIGHT CAR SYSTEM AND SPECIAL EQUIPMENT CARS

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF ARTS. in Economics

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T H E P R I V A T E F R E I G H T C A R S Y S T E M

A N D

S P E C I A L - E Q U I P M E N T C A R S.

INTRODUCTION.

Recent events have brought private freight car lines into prominence. Many popular articles have been written denouncing the evil practices of the companies owning such cars, the Interstate Commerce Commission has studied the situation and held special hearings for this purpose, and the Senate and House of Representatives Committees on Interstate Commerce received testimony in regard to their practices during the investigations prior to the rate legislation of 1905 and 1906.

The agitation against privately owned cars originated through complaints against the icing charges of certain powerful companies operating refrigerator cars, and, in fact, the whole controversy has centered around this type of car. Private companies also own cars built to carry cattle, oil, coal, furniture, and many other commodities, and differ in some important respects from the majority of the freight cars owned by the railroads, although they, too, own many of special design. By special equipment cars, we therefore mean those built to carry particular commodities. Box cars and flat cars are thus eliminated, and, although, perhaps coal cars ought to come under this head, yet they will not be treated to any extent in this paper.

It is difficult in some cases to draw the line between railroad ownership and private ownership. In general, it may be said that the status of a special-equipment car falls under one of three heads: first, it may be owned outright by a railroad; second, it may be owned by a separate corporation, but with the stock of that corporation owned or controlled by a railroad; or third, it may be owned by a person or company entirely independent of any railroad. It is when a car comes under this last heading that it is strictly speaking, a private car. Those owned by subsidiary corporations of railroads are operated in the majority of cases as if owned directly, and are therefore considered as railroad-owned cars. The difficulty in determining whether or not a car should be classified as a private car arises from the fact that it is not always plain whether the corporation owning the car is in turn owned by a railroad. This is especially true in the case of coal cars.

To understand the private car situation, it is necessary to make a study of the development of the principal kinds of special-equipment cars which are commonly owned by private companies. These are refrigerator, stock, and tank cars. It will be noticed that the refrigerator car is treated more fully than the others, because, as has been remarked before, the present agitation has centered around this type, and also because it greatly outnumbered either of the other kinds. The part that special-equipment cars have had in the development of the country will also be treated almost exclusively in connection with the refrigerator car.

EARLY HISTORY OF REFRIGERATOR CARS.

The early history of refrigerator cars is somewhat obscure. There are no statistics to show the number owned by private companies over a series of years, and it is impossible to enumerate them exactly even at the present time. There are conflicting statements as to which was the first refrigerator car used, and attempts that have been made to write up this history have had to be based more on the recollection of men who were alive at the time of the first attempts at refrigeration in transit, rather than on any definite and authentic records.

Probably the earliest attempts to refrigerate freight cars were made on the Michigan Central Railroad in the early sixties (1) for the carriage of fresh meat from Chicago to New York and Boston. Ordinary box cars were fitted up with platforms at each end, about three feet from the floor, with metal catch-basins to carry away the melting ice, and heavy swing doors suspended from the ceiling to hold the ice in place. These bins held from 2000 to 3000 pounds of block ice, and the ice could be placed in the car only when it was empty. A metal pipe carried the waste from the catch-basin through the bottom of the car. These were crude affairs, and can hardly be called refrigerator cars, but by carrying them on passenger trains as far as Suspension Bridge, N. Y., and there attaching them to fast freight trains, they were landed in New York in

(1) Ice and Refrigeration, September, 1904 -- p. 165.

about three days with the meat in good order. These attempts did not attract much attention, and were not successful enough to give any idea of the vast change that was soon to be brought about by the use of the more efficient refrigerator cars.

At about the same time, the Pennsylvania was also experimenting in refrigeration, under the direction of W. W. Chandler, who was for years at the head of the Star Union Line, and who did more than any other man in the early development of this kind of traffic.

It was about 1857, that Mr. Chandler had thirty box cars refitted with double sides, roof, and floors, and the interstices packed with saw-dust, and thus hatched what they present officers of the company claim to have been the first refrigerator cars. These cars had a hole in the floor between the doors, for the leakage of ice water, and a box of ice was put in the door after the car was loaded. Mr. Chandler called this the "Ice box on wheels", and it was used for the carriage of dairy products from the west. This car was soon improved by placing the ice in huge boxes hanging by iron straps in the end of the car.

At about the same time that Chandler was instituting refrigeration in transit over the Pennsylvania, experiments were going on in Detroit in order to perfect a more efficient car. The first patent taken out for a refrigerator car was that of J. B. Sutherland, of Detroit, Michigan, under date of Nov. 27, 1867. (1)

(1) W. A. Taylor in Yearbook of Department of Agriculture for 1900, -- P. 574.

In 1868, Mr. D. W. Davis, of Detroit, who had been experimenting since 1865, patented his improved refrigerator car, and this was one of the most widely used of the very early cars. A successful shipment of dressed beef from Chicago to Boston in September 1869, in this car, may be said to be the real beginning of the dressed beef industry. The Davis car came into competition with the car invented by Chandler on the Pennsylvania Lines, and present officials of the Star Union Line remember how they used to characterize the Davis car as a "sweat-box",--and this was undoubtedly true, for the old Davis car had no adequate means of ventilation.

The first attempts to refrigerate fruit in transit were probably made by Mr. Parker Earle in 1866, then residing in Cobden,⁽¹⁾ Illinois. In that year he built twelve big refrigerator chests for shipping strawberries by express. Each chest held 200 quarts of berries and 100 pounds of ice. When taken good care of, the berries carried well, but on account of carelessness in handling, the excessive express rates, this method had to be given up. Similar attempts were made about this time in the shipping of fruit from Charleston, S. C. to New York by steamer, and Georgia shipped her first peaches to distant markets by means of express in 1877. In 1868 a Davis car was brought to Cobden, Ill., and loaded with strawberries. The car contained a vertical cylinder in each corner, about fifteen inches in diameter, and was iced from the top of the car, salt being mixed with the ice. The result of this experiment was that part of the berries were frozen, while the balance of the load was unequally cooled, therefore the shippers suffered a loss, and did not feel encouraged to try it again. In the same year,

(1) F. S. Earle in Yearbook of Department of Agriculture for 1900, -- P. 444.

(1)

two carloads of Michigan peaches were shipped to New York in cars used on the Michigan Central for carrying meat. When they reached Suspension Bridge, N. Y. the cars were opened, and it was found that the heat thrown off by the ripening peaches had melted the ice, and that the fruit had spoiled, entailing a loss of over \$1,000 per car. The failure was due to the warmth of the fruit when shipped and to the lack of re-icing facilities en route.

In 1869, another carload of strawberries was shipped by Mr. Earle and other fruit growers from Cobden to Detroit in one of the Michigan Central cars. The ice melted in transit, owing to the removing of the plugs from the ice boxes in the roof by some railroad official in order to give the berries "a chance for a little air". When the car reached Mr. Earle, who had gone ahead to Detroit to make sure of a market, the berries were ruined, and the venture was a total loss.

Mr. Earle, however, continued his experiments, and built a cooling house in his packing shed at Anna, Ill. By leaving his berries in this house for twenty-four hours to cool off, and then sending them to Chicago by express, he found that they arrived in much better condition than those which were sent as soon as picked. He then went to Chicago and procured what was then the best refrigerator car that had been made,--the old Tiffany car--with ice-box V-shaped, suspended from the roof and running the full length of the car, carrying a maximum of a ton and a half, and which had been built to carry dairy products. After cooling the berries in the cooling house, they were placed in the car, and sent to Chicago. This was a complete success from the start, and resulted in placing

on the Chicago market more solid and better keeping berries than had ever been seen there. The date of this first successful shipment was 1872.

This car built for dairy products, however, was not very satisfactory, on account of its small ice capacity. What was needed was a car that would hold four or five tons of ice, so that the warm fruit could be cooled in the car, and then taken on a two or three day trip with safety. Mr. Earle soon had such a car built,-- one that was well insulated and with adequate ice capacity.

It was not until some time after this that fruit or vegetable shipments were made over any great distance, and the middle West and West were ahead of the East in the development of this traffic. Some of the initial shipments under refrigeration from districts that have since become important and well known

(1)
were: first shipment of garden-truck from Norfolk, Va., to New York City, 1885, and from North Carolina, in 1887; first car-load of oranges from Florida to New York, 1889; first shipment of strawberries from California to New York, 1888; first car-load of oranges from California to the East 1888. Shipments had been made in ventilator cars before this.

The introduction of refrigerator cars was carried on in the face of much skepticism and opposition, on the part of both the growers and the traders. It was generally believed that after fruit had been on ice, it would decay rapidly after being taken off. This is true of fruit that is over-ripe before being placed on ice, but is not true of fresh fruit if properly handled, and it took

(1) 12th Census of the United States, Vol. V.

many demonstrations to induce growers to send their fruit in refrigerator cars. The use of such cars consequently increased but slowly at first, and it was not until some time later that even the experimental stage was passed. Mr. Armour, in his book, "The Packers (1) The Private Car Lines, and The People" tells us that Mr. Hammond of Detroit was one of the pioneers in the use of the refrigerator car for the carrying of meat products, and that his first successful attempt was in 1871. In this car, the meat came in contact with ice, became discolored, and did not keep well after being removed. To obviate this difficulty, the meat was suspended from the rafters and ceiling, but the motion of the cars in going around curves set the halves of meat swinging like pendulums, so that this motion was communicated to the cars. Some railroad wrecks were attributed to this cause, and the hostility of the railroads was aroused. Then came the partitioning off of an ice bin at the end of the car, and later the true principle of refrigeration was discovered: that a current of air allowed to pass through an ice bunker in the upper corner of a car becomes chilled so that it is heavier than the air with which it comes in contact, and consequently sinks, circulates through the car, and the warm air passes out through the ventilator. It was not until this was adopted that refrigerator cars came at all into general use, and that refrigerator lines which could handle any extensive business were established. We shall now glance at the early history of some of these first lines, and see why they were built by private concerns and not by the railroads.

DEVELOPMENT OF THE PRINCIPAL LINES.

By the year 1870, there were powerful vested interests shipping live cattle from Chicago and other western points to the East. There were important stock yards at Cleveland, Buffalo, Albany, Pittsburg, Boston, and several other intermediate places where cattle were unloaded, fed and watered, and reloaded. These people were naturally strongly opposed to the development of the dressed-beef traffic and the consequent decline of cattle shipping. The dressed beef that was carried over the Michigan Central was insignificant in amount, and the business was not receiving any encouragement nor being developed. Mr. Gustavus Swift was the first to inaugurate an adequate refrigerator service for carrying dressed meats, and the first to demonstrate what could be done. ⁽¹⁾ In 1875 he began by experimenting with a few carloads, supervising the work personally. After finding someone to handle his shipments in the East, he started into do business on a large scale,--an undertaking at that time very bold and hazardous. He approached the Grand Trunk Railroad, whose route was so circuitous that it did not handle much live stock, and which consequently was not opposed to the development of the fresh meat traffic,--and suggested that it build refrigerator cars for the purpose. Mr. Swift was informed that the road would be glad to handle the cars, but that it was unwilling to build such equipment. The railroad claimed that it was too experimental a business, and that it could not afford to build the costly cars required. Mr. Swift was therefore thrown

(1) Winans, Charles,-- The Evolution of a Vast Industry.

upon his own resources, and it was necessary for him to build his own refrigerators if he wished to carry out the gigantic project of developing an extensive market for dressed beef in the East. This instance is noteworthy, for it, with many such refusals of railroads to build cars, gives us the reason for the early private ownership of special-equipment cars. Armour, in his book, recounts the same experience ⁽²⁾ when he started in to ship dressed beef; the railroad men themselves say that they refused at first to build such equipment. It is thus a significant fact that private ownership of special-equipment cars originated largely on account of the refusal of the railroads to build them, and the early development of traffic in perishable goods was thus due to private companies, and not to the railroads. This point should be borne in mind in our future study.

To return to the work of Mr. Swift, he went to Detroit and ordered ten refrigerator cars of the latest and most satisfactory type, and began shipping beef both summer and winter over the Grand Trunk. He soon added to his equipment and has gradually increased it until now he operates over 6000 cars. The consequent changes in the meat and live-stock industries will be studied in another place. The other refrigerator car lines built by Armour and Nelson Morris soon followed, as also those belonging to Cudahy and Schwarzschild and Sulzberger. These cars were built for carrying beef.

The first refrigerator line of any importance operated solely for the fruit traffic was that of F. A. Thomas, a fruit

(1) Armour, P. 22.

and produce dealer of South Water Street., Chicago. His line was started in the following way: ⁽¹⁾ A Detroit inventor named Carlton B. Hutchins perfected a refrigerator car in 1886, had fifty of them built, organized the Detroit Refrigerator Car Co., and operated them over the Michigan Central in the fruit and produce trade. Owing to a personal disagreement with the President of the road, Mr. Hutchins was obliged to cease operating his cars over the Michigan Central, and went to Chicago in search of some one who would use them. There he found Mr. Thomas and his son, who took them, and operated them in traffic to the East. In a few months Mr. Thomas prevailed upon the roads running to the Pacific coast to let him send five cars to California to test carrying fruit from there to Chicago. The fruit-growers were skeptical and would not allow their fruit to be shipped in these cars, so the Thomas firm had to buy their own fruit with which to load them. ⁽²⁾ The experiment was successful, and the possibilities in the development of this traffic were realized for the first time. This was in 1888. Soon, the Thomases, together with Mr. Hutchins, formed the California Fruit Transportation Company, (known as the C. F. T.) which rented cars of the Hutchins Refrigerator Car Company, a corporation which had been formed for the purpose of building and owning the cars, for \$8.33 a month each, and this company operated for a couple of years at enormous profits. This success allured others into the field. Soon the Goodell Line, owned by Porter Brothers, began in the California trade, and then came the Continental Fruit Express, (known as the C. F. X.) owned by Mr. Edwin T. Earl.

(1) Russell, Everybody's Magazine, March, 1905--P. 296, (I am informed by railroad men of Chicago who were in a position to know at the time, that Mr. Russell's early history is authentic.)

(2) J. C. Scales in Saturday Evening Post, March 10, '06.

It was about this time, (1890) that Armour became interested in the fruit traffic, and it is alleged that Earl got his first refrigerators from him. (1) At any rate, there soon ensued a fierce competition for the traffic, and cut rates and rebates were granted indiscriminately. Armour became allied with Porter Brothers, and later absorbed the company. The relations between Armour and this company were investigated in the Interstate Commerce Commission hearing of October, 1904.

The cutting of rates was carried to such an extent that the Thomas Company became embarrassed, and after a few futile efforts to maintain its business, it was forced to the wall. The C. F. T. was later absorbed by Swift, and is now one of the lines operated by him. Not long after this, the Earl Company, C. F. X., was bought out by Armour at a high price, for this company had increased its equipment and business and had not been driven to the wall under the stress of competition. After this, the fruits of California were carried mainly in Armour cars, until the Santa Fe began to build an adequate supply of refrigerators late in the nineties.

(1) Russell -- Everybody's March, 1906.

EARLY HISTORY OF STOCK CARS.

Ordinary stock cars were owned by the Railroads at a very early date, and there is nothing of particular interest about their origin. They are not so expensive to build as refrigerator cars, nor do they require the same careful supervision and constant care. Some stock cars were owned by private individuals early in the seventies; (1) Lansing Millis of Boston, and later Squires and Co., of the same city were among the first to enter this field, and they shipped horses, cattle, and hogs, from the Mississippi to the Atlantic Seaboard. Subsequently, they sold their cars to the Central Vermont Railway. The common method of caring for live cattle in transit, as has been explained before, was to remove them from the cars at intermediate points where there were yards, there to feed and water them, and then reload them. For this, the railroads claimed that their equipment was adequate, and opposed the private ownership of such cars. It was not until improvements which the railroads were slow in adopting, were introduced, that private companies began to own cars to any extent.

In 1883, an exposition of railroad appliances, under the direction of Mr. F. H. Talbot, then President of the Railway Age, was held in Chicago. At this exposition, which was well attended by railroad men, there were exhibited models of stable cars, or "palace live stock cars" for the better care of horses, cattle, sheep, and hogs, during transportation. These contained racks and troughs from which the cattle could be fed and watered in transit, and also moveable partitions which allowed the animals to lie down without danger of being trampled on. The Street stable car (1) Midgeley in Railway Age--34--368.

and the Burton stock car, which are commonly seen on the railroads to-day, were among those exhibited. It was claimed by the owners of these cars that their use saved a considerable amount in shrinkage of live-stock. Many tests were made and a select committee of the United States Senate, which took testimony on the transportation and sale of meat products in 1889, inquired into the matter. Some railroad men testified that from their experience, they believed that there was no appreciable saving from the use of the patent stock cars. (1)

(2) One man representing the American Live Stock Express Company, testified that the shrinkage common in ordinary stock cars was diminished 65% by the use of the palace cars of his company. (The shrinkage in ordinary stock cars was about 8 or 10% of total weight of animals during transportation of 2000 miles). At any rate, it was generally believed that there was a greater saving from the use of the improved cars. They were built with lighter springs, and it was testified that they were as well equipped with wheels, brakes, and couplers, as Pullman cars, and there were often allusions to the furnishing of "Pullman cars for the transportation of cattle". By 1889 there were seven companies owning and operating stock cars. (3)

The number of companies has not increased to any extent, although many of the old ones are still in business and have added materially to their equipment. The number of stock-cars, however, owned by private companies, is comparatively unimportant

(1) Testimony of T. C. Eastman, P. 514.

(2) Testimony of B. F. Holmes, P. 559.

" " J. B. Dutcher, P. 588.

(3) Street Stable Car Co.; American Live Stock Express; American Live Stock Transportation Company; Burton Car Company; Delaware and Lackawanna Live Stock Line; Canada Cattle Car Co; Mathews Car Company; Herington Transportation and Sale of Meat Products. P. 56.

as compared with the number owned by the rail-roads, and there have not been the objections to their use as there have in regard to refrigerator cars.

HISTORY OF TANK CARS.

Simultaneously with the introduction of improved cattle cars, came improved methods for the transportation of petroleum and its products. The ordinary way to ship oil was in barrels, which were loaded into ordinary box cars. The barrels often leaked, the cars became saturated with oil, offensive, and likely to take fire.⁽¹⁾ For these reasons, cars with large iron tanks, cylindrical in shape, were introduced, into which the oil was run in bulk from reservoirs at certain stations where the refined product was collected. Only large establishments could afford to provide such expensive equipment, and since the freight rate on oil carried in tank cars was lower than on that carried in barrels, the ownership of cars was a distinct advantage to the large shippers. Furthermore, the owners of these cars refused to lease them to other companies, and the railroads would not supply equipment of their own, and never have done so to any extent since. The Standard Oil Company created a subsidiary concern,--The Union Tank Line--which built and handled tank cars,--and which has always been the most important company operating such cars. It now owns about 10,000 of them.

On account of the advantage obtained by the large producers in owning tank cars, and especially because of the lower freight rate for oil carried in tanks, there was widespread opposition to their use. The Interstate Commerce Commission, in considering this question, stated that it was the duty of the railroads to provide equipment for their patrons, and that failure on the part of shippers

(1) Midgeley--Railway Age 34-369.

to own such equipment should not result in a discrimination in rates against them. (This question of ownership by the railroads will be considered later).⁽¹⁾ As a result of this, the rates on oil in barrels were lowered, and those on oil in tanks were raised, --but this only partially diminished the discrimination in favor of the large shipper, and so the opposition continued.

Another ground for dissatisfaction on the part of the small refiner was that the rate on oil in tanks was on only the oil itself, while in the case of that shipped in barrels, the weight of the barrels was included in the charge. Commenting on this, the Commission declared that the tanks were as much a package for the carrying of oil as the barrel was, and that the practice of not charging for the weight of the tank was therefore an unjust discrimination. In accordance with opinions of this sort many complaints were filed by independent oil companies against certain railroads, alleging violation of the Interstate Commerce Commission Act. The Oil cases, as considered by the Interstate Commerce Commission are to be found in the first six volumes of its reports. This early history of oil transportation is ably told by Mr. J. W. Midgeley in his articles in the Railway Age,⁽²⁾ especially as he himself was personally active in the controversy, and in the attempts made by the railroads to reduce the mileage paid to tank car lines. These attempts were eminently unsuccessful, and are only another evidence of the power that Standard Oil had over the railroads. For instance, in 1894 at a conference of Western railroad men, it was decided to reduce the mileage on private cars to six mills,

(1) Midgeley, Railway Age 34-400.

(2) Railway Age, 34--401.

instead of $3/4$ cents and one cent a mile. The Union Tank Line informed the railroads that they would get no oil shipments to Saint Paul and Minneapolis unless the mileage of $3/4$ cents was restored, and that all the traffic would be diverted to some road which would pay the mileage. This was eventually done, a "weak sister" was found, and the vast shipments of Standard Oil were crowded into this line. Within a few months, however, the other roads gave in, and resumed the payment of the mileage demanded for the sake of recovering the lost traffic.

An interesting item in connection with this controversy with the Union Tank Line was an offer made by the line to the railroads either (1) that they buy the equipment of the company outright or (2) that the company turn over its equipment to the railroads to operate, in return for which the company was to receive interest on the appraised value of the cars, plus a mileage of six mills per mile to cover expenses for repairs, etc. The second proposition was dismissed at once; the first was considered, but soon given up. This is of interest, because one solution of the private car question lies in this direction of ownership by the railroads. This point we shall consider later on. It may be well to remark in passing, however, that the fact that the Union Tank Line was willing to sell its equipment to the railroads, may be considered as evidence that the company was not making any large profits,-- and it has since been brought out in Interstate Commerce Hearings (1) that the company has actually operated at a loss some of the time.

(1) 1904 Hearings, Interstate Commerce Commission. P. 219.

NUMBER OF PRIVATE CARS.

As has been said before, the exact number of privately owned cars in the country is impossible to determine, and all estimates are necessarily only approximate, on account of the failure of many companies to make reports as to the equipment owned and operated by them. The Railway Equipment Register has the most complete statement of the different companies, with the number and description of their cars. Various estimates have been made: in 1900 attorneys for the Continental Fruit Express Company stated that the aggregate number of private cars in the country was about 113,000, of which 50,000 were refrigerator cars. ⁽¹⁾ The estimate made by Mr. J. W. Midgeley in the Railway Age for October 10, 1902, is probably the most accurate, and yet that was five years ago. His estimate of the number of cars, together with their value is here given.

<u>KIND OF CARS</u>	<u>NUMBER</u>	<u>VALUE PER CAR</u>	<u>TOTAL VALUE</u>
Refrigerator	54,522	\$800	\$ 43,617,600
Box	21,178	500	10,589,000
Tank	14,531	600	8,718,600
Stock	11,139	600	6,683,400
Coal	16,143	500	8,071,500
Flat	853	450	383,850
Furniture and Vehicle	1,533	600	919,800
Poultry	325	800	260,000
Unclassified	10,622	500	5,311,000
Total -	130,846		\$84,554,750

(1) Brief and argument for the Continental Fruit Express Co., Intervenor in Southern California Fruit Exchange vs. Southern Pacific, Sante Fe, et al., tried before Interstate Commerce Commission, March 30, 31, 1900.

In 1906, the number of private cars enumerated in the Railway Equipment Register (July 1906) as nearly as can be told from the nature of the reports therein, was about 127,000. Some lines are omitted from this, however, as for instance most of the Armour lines, the Continental Fruit Express, owning 1745 cars, being the only line operated by Armour, included in the Register. This, at once, then shows an omission of about 12,000 cars, and then add 10,000 more for possible omissions, this will give us about 150,000 cars, and probably this is not far from the actual number in the country to-day. The total number of freight cars owned by the railroads in 1905 was 1,692,194, a little over ten times the number of private cars.

DEVELOPMENT OF RAILROAD OWNERSHIP OF REFRIGERATOR
AND STOCK CARS.

One thing to be noticed particularly in connection with the development of special equipment cars is that it has been comparatively recent, and not until the latter eighties were they numerous enough to play any important part in the railroad problems of the day. The ordinary stock cars were owned and used by the railroads at an early date. The palace stock cars, however, were not used until the eighties, and these were the ones which were owned by private companies. We have seen that refrigerator cars were generally owned at first by private companies, and that it was about 1890 before there were any important lines which carried perishable products outside of beef. The development of refrigerator cars has thus taken place only within the last fifteen or twenty years, and, in fact, the traffic in perishable goods may be considered as still in its infancy as compared with what the prospects are for the future.

Although the railroads at first refused to furnish refrigerator equipment of their own, it was not long before certain roads, which covered extensive sections of the country, and which had a diversity of climatic conditions along their lines, began on a small scale, to build such cars. In 1885, the total number of refrigerator cars owned by the railroads in the country was almost exactly 1000. Such roads as the Illinois Central, Missouri Pacific, Louisville and Nashville, and the Union Pacific were among the pioneers in this, and the largest number that was returned by any

(1)

one road in 1885 was 162, owned by the Illinois Central.

Mention should be made here of the old-fashioned ventilator or fruit cars. These had openings on the sides and ends, covered with wire screens or overlapping boards with spaces through which the air could pass. They were built especially during the eighties and early nineties, for the purpose of carrying fruit and vegetables. Many of them are seen on the railroads to-day, but generally in a delapidated condition, for they are being rapidly replaced by the more efficient refrigerator cars, and very few have been built during the last few years. They were of no value in winter, when there is as much need to keep perishable freight warm, as there is in summer to keep it cool. Furthermore, they could not reduce the temperature of a car below that outside, and they were only valuable in providing fresh air for the contents of the car and in allowing the warm air caused by the ripening fruit to escape, while the car was in motion.

To return to the question of railroad ownership of refrigerator cars, the growth of their number is shown in the following table:--figures compiled from Poor's Manual for five year periods:

<u>YEAR</u>	<u>NO. OF CARS</u>
1885 - - - - -	990.
1890 - - - - -	3,398.
1895 - - - - -	7,043.
1900 - - - - -	10,760.
1905 - - - - -	24,570.

(1) Figures taken from Poor's Manual.

From this table it will be seen that the increase has been uniform and very rapid, especially since 1900. Prior to that date no particular attention was given by the railroads to this branch of their business, and their refrigerator cars had no special supervision. In 1900, the Chicago, Burlington, and Quincy organized a separate refrigerator car division,--a part of the traffic department,--and placed an able man at the head of it to study conditions, to provide for the proper carriage of perishable products originating along the lines of the road, and to stimulate the production of such goods. The organization of this separate department was done more or less as an experiment, and it was doubted whether it would pay to go to the extra expense. As a result, however, the tonnage of perishable freight increased almost 100% in three years, (1)

and the creation of the department was soon justified. Other roads soon realized the possibilities in this direction and organized similar departments. The Santa Fe owns the largest number of cars, about 6000, and operates them under the name of the Santa Fe Refrigerator Despatch Company. (2) During the past year, (1906), the Harriamn Lines have ordered 6600 refrigerator cars and organized a separate department to operate them, known as the Pacific Fruit Express, and this will displace Armour cars on the Southern Pacific and Union Pacific roads. This fact is significant, in that it illustrates the tendency that there is to-day for railroads to own their own equipment. The reasons why a separate department should have charge of refrigerator equipment are: first, the traffic department is too busy in trying to increase tonnage to undertake

(1) Railway Age, Jan. 30, 1905.

(2) This company is really a separate corporation, but is so closely allied with the Santa Fe Railroad, that it will be considered as a department of it.

to look out for the special service necessary in the handling of perishable traffic; second, it is necessary to have some one study conditions along the line so as to be able to anticipate the moving of fruits by having cars provided; and third, the icing of cars, the location of icing plants, etc., need careful study and supervision.

Another method of railroad ownership of refrigerator cars is through the formation of a separate company, the stock of which is owned by the railroads, but which operates over certain lines as a distinct organization. These cars, although not bearing the name of any particular railroad, should not be classed with private cars. The two best examples of this are the American Refrigerator Transit Company, and the Merchant's Despatch Transportation Company, (1) The American Refrigerator Transit Company, (commonly known as the A. R. T.) originated as a private company which operated over the Wabash and Missouri Pacific Railroads. It was gradually absorbed by these roads so that it became a subsidiary concern of the Gould lines, over which it now operates its 4500 cars. The Merchant's Despatch Transportation Company, (known as the M. D. T.) is a fast freight line belonging to, and operating over the New York Central Lines. Besides owning 4850 refrigerators, this line owns over a thousand ordinary box cars. Seventy of its refrigerators are assigned exclusively to American Express Company service, and are completely equipped for use in passenger trains.

As for the ownership of stock cars by the railroads, the figures for five year periods are as follows:

(1) Interstate Commerce Commission Hearings, in Chicago, Oct. 1904
Hearings of Senate Committee on Interstate Commerce, May, 1905,
Vol. III. P. 278.

<u>YEAR</u>	<u>NO. OF CARS.</u>
1885 - - - - -	43,900
1890 - - - - -	54,900
1900 - - - - -	46,150
1900 - - - - -	38,150
1905 - - - - -	44,893.

It is interesting to note that the decade 1890-1900 shows a considerable decrease in the number of stock cars. This is partly accounted for by the changes brought about in the live stock and packing industries through the use of the refrigerator car and the subsequent shifting of the packing centers to the westward. Formerly, cattle were carried to the Atlantic seaboard to be slaughtered, but with the growth of the dressed meat traffic, the need for cattle cars on the eastern roads diminished. The increase in the number of cars since 1900 is due to the extension of stock raising further to the West of the packing centers. These effects on the live-stock and dressed meat industries will be studied later.

CONSIDERATIONS ON THE TECHNIQUE AND OPERATION OF REFRIGERATOR CARS

The art of refrigeration has advanced with rapid strides and the use of mechanical refrigeration in cold storage warehouses, working in conjunction with refrigeration in transit, has had its beneficial effect on the fruit industry. Apples, especially, are thus held in cold storage, in order to keep them in sound condition during the fall and winter. During the early seventies, mechanical refrigeration was used in the packing houses to chill meats before shipment, but it was not until almost 1880 that cold storage warehouses were built for storing of fruit. Since that time, the number of such plants has increased, according to an estimate made in 1901, to 600 establishments in which fruits and produce are stored under mechanical refrigeration. ⁽¹⁾ By mechanical refrigeration is meant the cooling process which is based on the principle that an expanding gas absorbs heat. Ammonia gas is chiefly used for this purpose, and by means of careful insulation, and well constructed plants and machinery, it is possible to maintain definite temperatures for long periods with very slight variation, after the initial heat of the stored product has been absorbed and removed.

The problem of refrigeration in freight cars is a more difficult problem, however, and has not been so satisfactorily solved as in the case of stationary plants. In the first place, no application of mechanical refrigeration has been devised which can be used in cars, and therefore ice has to be used. Other reasons why it is more difficult to attain efficiency in the cooling of cars, (1) Taylor in Yearbook of Department of Agriculture, 1900.
P. 569. (The number now is probably 1000.)

than in warehouses, are that the temperature is higher, the moisture greater, the distribution of cold air less uniform, and the refrigerating power less efficient. (1) As we shall see later, these difficulties have not been entirely overcome in the refrigerator car, although great progress has been made.

Nearly 400 patents have been taken out in the United States (2) with a view to improvement in the refrigerator car service. The patents cover construction, air circulation within the car, ventilation, the capacity and arrangement of ice tanks, mechanical and chemical refrigeration, and various other subjects. Those that have involved any complicated mechanism have proved impracticable, and those that are in use have been selected with a double view of efficiency in refrigeration and adaptability to the requirements of modern railroading. Anything that delays the movement of trains, or that is beyond the skill of the ordinary brakeman to handle is clearly out of place.

The construction of the latest-improved refrigerator cars, in a few words, is as follows: the roof, sides and floor, are built double, and the space is generally filled with felt or heavy paper so as to furnish as perfect insulation as possible. The ice bunkers are at the ends and extend from the top to within a few inches from the bottom of the car. They are filled with ice from the top where there are two openings, or hatches, for each bunker. Underneath the hatches, there is a tight fitting plug, which, when forced into place renders the passage of air from the outside prac-

(1) Powell in Yearbook of Department of Agriculture for 1905. P. 356.

(2) G. Harold Powell in a paper read before the American Society of Refrigerating Engineers, New York, Dec. 4, 1905.

tically impossible. When a car is running under ventilation, these plugs can be turned so as to drop down into the bunkers, allowing the free passage of air. In this case, the hatches are left open at an angle of about 45° so as to catch the air, and force it into the car. The Mackintosh ventilator, used on the Santa Fe cars is a V-shaped metal contrivance which can be opened up so as to catch the air, and this is an improvement on the commoner method of merely opening the hatches part way.

The bunkers are partitioned off from the end of the car sometimes by means of a wooden partition with openings about a foot and a half wide, at the top and bottom, and sometimes with an iron grating, covered with overlapping strips of metal, allowing the free circulation of air from all parts of the bunker to the rest of the car. This latter device is called the Bohn Patent, and the best cars are now supplied with it. Under each bunker is a catch basin for the melting ice, and drain pipes carry this waste through the bottom of the car. The bunkers in the best fruit cars hold together about five tons of ice. Those built for the carriage of dairy products and meats have a smaller ice capacity, some of only a ton and a half, and this constituted the principal difference between the fruit car and the meat car. In those cars having large ice capacity the bunkers extend in about two and a half or three feet from each end of the car, thus taking up valuable room that might otherwise be used for freight.

In the refrigerator cars in use today, the temperature usually falls to between 40° and 50° F. Perishable fruit is usually loaded into cars direct from the orchard, and its temperature approximates the temperature of the atmosphere. In the South and in the western

semi-arid parts of the country it is sometimes loaded at a temperature of 95°. The rapidity with which the temperature of the fruit in the car will fall during transit depends much upon the manner in which the fruit is packed and loaded. If the fruit is not wrapped, and is packed in fairly open packages, - and if spaces are left between the tiers of packages when loaded in the car, - as in the case of Georgia peaches, for instance, it may cool gradually to 42° or 45° F. ~~when~~ in three days in the bottom of the car, if the fruit is at 85° F. when loaded. At the same time, the fruit in the top of the car may be 10° warmer. ⁽¹⁾ A car of peaches, in which the fruit is wrapped, and packed in boxes which are piled closely together, may take twice as long to cool down on account of the insulating effect of the paper and the poorer circulation of air between the boxes. Ordinarily, the temperature in a refrigerator car continues to fall uniformly in transit, if the icing is well done. For fruit, block ice without salt is generally used. In the shipment of meat, it is refrigerated before shipment, and is carried at a temperature ranging from 34° to 40° in transit, the lower temperature being due to the use of broken ice with an addition of about eight or ten per cent of salt.

As we have just seen, the temperature in the upper part of a refrigerator car is generally about ten or fifteen degrees warmer than that in the lower part. As a consequence of this, the fruit in the upper tiers is sometimes over-ripe when it reaches market, while that at the bottom is in sound condition. In fact, cars are not usually loaded to their full capacity, because it does not pay

(1) Powell in Yearbook of the Department of Agriculture for 1905. P. 356.



to utilize the warm upper portion. The fruit in ripening throws off a large amount of heat, and no appliances have as yet been devised which insure a circulation of cold air throughout the whole car and carry off the heat caused by the ripening fruit. Since the fruit is hot when loaded, it ordinarily takes from two to five days to reduce the temperature to a degree of cold that retards the ripening and the decay. During these first two or three days, when, the car is warm, the ripening springs forward, and since the atmosphere is moist, the rot often begins to grow vigorously.⁽¹⁾ These are fundamental difficulties in the present method of handling fruit for transportation, and have a far-reaching influence on the development of the trade. The extent of the market is limited by the distance that the fruit in the upper part of the car can be safely carried, even though that in the bottom could stand a few more days in transit. A solution of these difficulties would tend to develop more distant domestic, and also foreign markets, and would obviate the difficulty of having to pick hard and unripe fruit which often reaches the market in an insipid and flavorless condition.

The pomological experts of the United States Department of Agriculture have been investigating this phase of the problem and they estimate that the loss from deterioration of fruit during shipment amounts to over a million dollars per annum for the whole country, and to \$5000,000 in transporting the California orange and lemon crop alone.⁽²⁾ They have found that this deterioration is due not only to inferior transportation facilities, but also to mechanical bruises received while picking, sorting, and packing the fruit

(1) Powell. - Problems in the transportation of fruit.

(2) Powell. - Problems in the transportation of fruit, P. 10.

in the orchards. Much progress is being made, however, in minimizing losses attributable to this latter cause.

The Department of Agriculture has been experimenting in the cooling of fruit in cold storage warehouses before shipment, and therein lies a possible solution of this difficulty. Eastern-grown pears for export are refrigerated in cold-storage warehouses alongside the railroad before shipping. Peaches that ordinarily develop considerable decay in the top tiers of packages have been shipped by the Department of Agriculture after cooling to about 40° F., and have reached distant markets in prime condition. In one shipment of 8000 packages less than one per cent of soft and decayed fruit developed in the two upper tiers, while five to thirty per cent developed in ⁽¹⁾ the ~~two~~ ~~upper~~ cars cooled in the ordinary way. In the semidesert Imperial Valley of California, a cold-storage plant has been erected for the manufacture of ice and for the cooling of cantaloupes before shipment. The melons are often above 100° F., when picked, and they are placed in the warehouse where they are reduced to about 40° before loading. The great objection to this plan is the additional cost of the necessary plant, which may be used only a few months or even a few weeks during the year. The only way that it is possible is to have them erected either by large associations of growers, or by the refrigerator car lines or railroads, and handled as a part of the refrigeration service.

Another method that has been tried for cooling fruit before shipment is to cool it in the cars after it has been loaded, by forcing cold air through an insulated tube from a cold-storage ware-

(1) Powell in Yearbook of the Department of Agriculture 1905. P. 358.

house into the car through the bunker. An exhaust fan draws the air out at the other end of the car. This has been tried at Los Angeles, California, but has not proved very efficient, because it was found to take from thirty to forty hours to cool the fruit in the center of the packages to 40° F. A more successful application of this same principle is in use in a large cold-storage plant at Springfield, Mo., where bananas in cars are cooled in transit. The plant consists of a shed with four tracks, which will hold forty cars, and the cold air is carried by large air ducts along the top of the shed, and forced into the cars through canvas tubes. The same plant may be used in winter to raise the temperature of the fruit when desired.⁽¹⁾

The foregoing considerations go to show that there is much room for improvement in the handling and transportation of our fruit crops, and as the output of the fruit districts is increasing, fruit the problem of extending the market becomes more and more important. No country in the world has its facilities for handling perishable products so thoroughly developed as the United States, and we have the only highly developed fruit car service in existence. Very little has been done in this direction in European countries. In England, refrigerator cars are used only to a small extent, as the climate there is seldom so extreme as to make them necessary.⁽²⁾ In France, the matter was looked into by Mr. Wm. A. Taylor of the United States Department of Agriculture in 1900 in connection with forwarding of the American fruit exhibit to the Paris Exposition in that year. He could learn of but one refrigerator car line in that

(1) Powell in Yearbook of the Department of Agriculture for 1905. P. 359.

(2) Letter from W. M. Acworth, London, Eng.

country, and that was not much partonized by shippers of other articles than meats and fish. The rail hauls in European countries are so much shorter than in the United States, that refrigeration in transit is much less important than in this country. (1)

The value of having a car thoroughly insulated and carefully constructed so that none of the outside air can penetrate is well illustrated by the temperature of a refrigerator car in the winter time, when it is necessary to keep perishable freight from freezing. Except in extreme cold weather, the temperature in a well-built car may not fluctuate two degrees in ten days. Tests made by the Santa Fe show that as the outside temperature fluctuates 30° to 40°, the inside temperature fluctuates only 4° or 5°. Experiments made by the Burlington people demonstrate that in zero weather a well-built refrigerator car will maintain a temperature about 20° higher than an ordinary box car for a number of days. Even the length of time that a car has been built makes a difference in the temperature, for in a new car, it is apt to be from 5 to 10° higher in cold weather than in an old one. In extremely cold weather cars have to be placed in round houses in order to keep the inside temperature from falling below the freezing point. The following table, taken from a copy of instructions issued by the Refrigerator Department of the Chicago, Burlington and Quincy Railroad, shows the temperatures at which it is necessary to place cars loaded with perishable freight in roundhouses. Only a few items are selected.

(1) Letter from W. A. Taylor, Pomologist in charge of field investigations, Washington, D. C.

When loaded in

	<u>Box cars</u>	<u>Refrigerator cars</u>
Apples	20° above Zero	Zero
Cauliflower	20° " "	"
Eggs	20° " "	"
Lemons and Oranges	25° " "	"
Peaches	25° " "	"
Potatoes	30° " "	"
Strawberries	30° " "	"
Tomatoes	30° " "	"

Shipments will stand about five degrees lower temperature if the cars are kept moving than when standing. Cars of dressed meat, fish, and dressed poultry are iced with cracked ice and salt the year round, and the addition of salt, maintains an even temperature so that there is no danger from freezing.⁽¹⁾ Sometimes cars are artificially heated during cold weather and large oil stoves are generally used for this purpose. About 1903 the Burlington equipped a number of its cars with steam heaters at a cost of about \$100 per car, with no extra charge to shippers, and it is the only road that has attempted this. During the winter of 1906-07 it has been experimenting in heating by steam from the locomotive, solid trains of refrigerator cars.

The operation of refrigerator cars, by either a private car company or by a railroad, requires the maintenance of a system of icing stations, an efficient corps of inspectors, and also an adequate system of administrative and accounting machinery.

(1) These two statements are taken from instructions issued by various railroads for the care of refrigerator cars.

The placing of icing stations along the route is illustrated by the description of a shipment of oranges from Los Angeles to Boston, given by Mr. Armour, in his book. ⁽¹⁾ The car is iced before receiving its load, and the placing of the hot fruit in the car causes such a heavy shrinkage of ice that it has to be re-iced before starting on its journey eastward. If passing over the Southern route, the car is halted at Tucson, Arizona, where it is thoroughly re-iced again. The same process is repeated at El Paso and Fort Worth, Texas, at Kansas City, Mo., Galion, Ohio, Hornellsville, New York, and East Deerfield, Massachusetts, making nine or ten times that the operation is necessary. These icing points make necessary the maintenance of ice-houses, and the procuring of sufficient ice sometimes at great expense, especially in warm climates where natural ice is not available. In 1905, Armour claims to have bought more than 120,000 tons of ice in California alone. The refrigerator car department of the Burlington publishes a list of sixty-five icing stations along the lines of its system; the Rock Island has about fifty.

Refrigerator cars require the most constant care and attention, and the railroads, issue specific directions to their agents as to their proper handling. In the first place, refrigerator cars have to be kept sweet and clean, for if they become saturated by any offensive odor they are rendered unfit for the carriage of perishable products. Sometimes when a car is being returned for a load of perishables it is loaded with commodities which emit such odors, and instructions generally include a list of articles which cannot be placed in the cars. For instance the Burlington includes

a rule in its special instructions to agents which forbids the loading of hides, tallow, or grease, Limburger cheeses, oil or empty oil barrels, bones or fertilizers, tar or tar-paper, in its refrigerator cars. It also forbids the loading of musical instruments, plated stoves or castings, tin plate, or any freight subject to rust or other damage on account of dampness in the car.

General instructions from the head office also provide for the cleaning of bunkers when necessary, the testing of drain pipes, and the method of handling different kinds of shipments when under refrigeration, under ventilation, or during cold weather. Condition of cars, amount of ice placed in bunkers, the roundhousing of cars, etc., - all these things have to be carefully recorded by the agent and sent on prepared forms to the head office. Sometimes a messenger accompanies the cars to see that all these things are properly attended to. The car line agents and inspectors are stationed at all important points to look after the movement of cars and to make the reports above alluded to, to the head office. In the case of a railroad's owning its own cars, many of these duties are attended to by regular freight agents, but it has been found necessary by those roads operating an extensive equipment, to maintain a separate corps of inspectors for this branch of the service on account of its specialized character. The Santa Fe, for instance, has found it necessary to maintain such a corps of agents for the proper handling and care of its refrigerator equipment.

The transmittance of the various reports of the agents which are stationed all over the country to the head office, requires a careful system of records and accounting to be kept at this office, and consequently a large corps of clerks. For instance, let us

glance at the organization of the Armour Car Lines, the largest and most important company in the country. Its main offices in Chicago are divided into two parts, which may be called the administrative and the car-accounting departments. The administrative department is situated in the same building with the general offices of the Armour and Company. Here the general policy of the company is laid down, icing charges are fixed, claims are adjusted and settlements are made. In the car-accounting department, which is located in the Union Stock Yards in Chicago, the movement of cars throughout the country is recorded, and the system is so complete that the whereabouts of any particular car of the 14000 operated can be ascertained at any time. For this purpose reports are made by agents stationed at the principal junction points, and sent by mail on postal cards which are printed according to a certain form and distributed by the head office. They show the number of the car, the time of passing a certain point, the road it is travelling over, the place of loading, destination, and routing. At the office in Chicago a separate record is kept for each trip that a car makes, and the forms used for this purpose are filled out as returns from the agents are received. When a car has completed its trip, there is thus a record of the journey from starting point to destination, showing the character of the contents, and the times that the car passed certain points en route. Any question regarding claims, mileage, contents of car, or any other information may therefore be settled by reference to these records, which are filed away and kept for three or four years before they are destroyed. Some of the railroads operating refrigerator cars utilize the telegraph for reports from agents, and often times these reports are more complete,

including condition of car, quantity of ice in the bunkers, etc. Instructions issued by the general offices are often very specific and cover a great variety of details.

PART THAT EQUIPMENT CARS HAVE PLAYED IN THE
DEVELOPMENT OF THE COUNTRY

In defence of private cars, general statements have often been made to show the wonderful things they have done in the development of certain industries, such as meat~~x~~ packing, fruit and vegetable growing; the opponents answer that it is not necessarily the private car that has done all this, but that it is the refrigerator car, whether owned by private individuals or by the railroads, that has accomplished it. Inasmuch as private concerns built the first refrigerators, and since the railroads refused to furnish this equipment for years, the defenders of private cars have more or less reason for their claim. It is our purpose, however, to study the effect of the special-equipment car itself on the development of the country, and to disregard the question of railroad or private ownership at present. Little has been written on this phase of the question, and it is not generally realized what a tremendous factor these cars have been in the economic and industrial history of the country.

Of course there are many kinds of special equipment cars built for different kinds of traffic, such as those for the carriage of furniture, farm machinery, carriages, stone, breakfast foods, beer, etc., etc., but we are primarily interested in the refrigerator car, for that is by far the most important. It has revolutionized the live stock and dressed beef industries; it has made it possible to

transport fruit and vegetables across the continent, and across the ocean, and has therefore resulted in the development of certain sections of the country which would have otherwise remained poor on account of their distance from market. Some of the most important changes it has brought about we shall now consider.

EFFECT ON BEEF-PACKING INDUSTRY

As we have seen before, meat, in early times, was furnished by local slaughter-houses and the live animals were either shipped in the ordinary cattle cars of the railroads from the West to the Atlantic Seaboard, or raised locally. There were extensive stock yards and slaughter-houses in all the principal cities of the East, and the carriage of live animals was an important item in the traffic of the trunk lines. During the seventies, as we have seen, dressed beef began to be shipped from Chicago to eastern markets in refrigerator cars.

It is easily realized what great economies were made possible by this change. The weight of edible beef derived from a steer is only 50 to 57 per cent of the entire weight of the animal. In those early days, all the rest was absolute waste, and the slaughter-houses even paid sometimes to have it carted away. In other words, shipment of cattle meant the payment of freight on a steer weighing 1000 pounds in order to get about 550 pounds available for market. Furthermore, there was a deterioration in the value of cattle after a carriage of 1000 to 2000 miles in cattle cars; many became sick and died en route, there was always a considerable shrinkage in the weight of the animals, and the general quality of their meat was impaired. These economies were readily recognized and the shipment of dressed meats became general. As a result of this, the great packing centers of the Middle West began to spring up, and consequently, the slaughtering of cattle in the East began to fall off. The following figures demonstrate this tendency.

TOTAL VALUE OF MEAT PRODUCTS FROM SLAUGHTERING
(1)
AND PACKING.

	<u>1880</u>	<u>1890</u>	<u>1900</u>
Boston	\$ 7,096,777	\$ 2,782,823	\$ 1,392,010
New York	29,297,527	50,251,504	38,752,586
Chicago	85,324,371	203,606,402	256,527,949
Kansas City	965,000	39,927,192	73,787,771

At one time, Chicago was near the borders of the cattle-growing country, and the short haul to that point soon made it by far the greatest live stock and packing center in the country. The cattle raising country gradually extended further and further westward and the Chicago packers followed this westward movement by erecting plants at Kansas City, Omaha, St. Louis, St. Joseph, St. Paul and even followed the industry to Texas and built great plants at Fort Worth. This shifting of the meat packing centers, then is a direct result of the use of the refrigerator car.

The westward movement of the cattle-raising industry, itself, has likewise been made possible by the refrigerator car. In the early days, when live cattle were shipped, the distance from West of the Missouri River to the Atlantic Coast was too great, and the expense of marketing the cattle too high, to make the raising of live stock profitable. With the introduction of refrigerator cars, the utilization of the vast grazing districts of the West was made possible. Thus, not only is the entire dressed meat industry de-

(1) 12th Census of the United States, Vol. IX., P. 391.

pendent on the refrigerator car for its existence, but also the raising of live stock has been extended, and many states have been developed and made wealthier through its use. As the Census of 1900⁽¹⁾ says: "The importance of artificial refrigeration to the meat trade would be hard to overestimate. The most important step in the development of American beef as an article of commerce, was the invention of the refrigerator car by William Davis of Detroit."

(1) Vol. IX. P. 416

EFFECT ON AGRICULTURE

Fully as important as the part that the refrigerator car has played in the development of the meat packing industry, is its effect on agricultural development, in connection with both fruit and vegetables. It was not very long ago when fruit was raised on a small scale, as it could be consumed only locally, and could not be transported for any considerable distance. Fruit could be had at any given place only at the time it ripened there, and any that was brought by express or other means a little before or after the short season of three or four weeks was very expensive, and considered a great luxury. As a result of refrigeration in transit, these conditions have all been changed; fruit is carried from most remote sections of the country to the large cities throughout the year, and it is no longer considered a luxury as it was once, but is looked on as a staple article of food. As Mr. Armour says in his book on private cars, "The operation of private fruit refrigerator cars has changed the growing of fruits and berries from a gamble to a business, from a local incident to a national industry." Few people realize what an enormous business fruit growing has become under the impetus given it by refrigerator cars, and not even the Department of Agriculture has adequate statistics on the fruit crop, which Mr. Armour estimates at about (1) \$400,000,000 a year. In 1899 the principal fruit-growing dis-

(1) Armour p. 93. (This estimate is undoubtedly too high. The 1900 census placed the figure at \$130,000,000, but owing to the imperfect returns, and the increase since that time, this figure is much too low.)

districts of the country shipped under refrigeration only 9164 cars; in 1905 the same districts shipped 42, 982 cars. This gives some idea of the rapid growth of the industry during the past few years.

California offers perhaps the best illustration of the development of fruit growing through the use of the refrigerator car. It is the greatest fruit-producing state in the country, it is situated at the greatest distance from the important markets, and therefore depends particularly on transportation facilities. The first car-load of 300 boxes of oranges is said to have been shipped in 1876. This was not under refrigeration. Ventilator cars were used for a number of years, and fruit grown on the uplands, where it was dry, carried fairly well, even as far east as New York and Boston. Solid fruit trains of ventilator cars were run on express schedules from Sacramento to Chicago for a number of years, and by 1886 shipments had reached 1000 cars per annum. In his book "The Modern Farmer", Mr. E. F. Adams tells of the first attack on eastern markets with deciduous fruits from California; fresh fruit was shipped in ordinary freight cars attached to passenger trains at a cost of \$1400 for ten tons, or seven cents per pound. In contrast to this, he says that in 1894 this trade had increased to over 7000 cars, at a cost of one and one-fourth cents per pound.

It was not until 1887 that the refrigerator car made its appearance in California and Mr. F.A. Thomas was probably the pioneer in this direction. He sent some of his own cars there but found that the growers would not use them, believing that fruit shipped in iced cars would be injured in flavor and in keeping

(1)

quality after removal from the cars. Mr. Thomas was therefore obliged to buy fruit with which to load his cars, and shipped it successfully to Chicago. The following year, growers were induced to use the cars, and the experience of 1888 demonstrated beyond all question the usefulness and practicability of the refrigerator car when properly handled. Deciduous fruit was first shipped this year under refrigeration from California, a carload of ripe apricots and cherries being successfully sent to New York without re-icing. The facilities for transportation under refrigeration were very crude in those days, and there was not what could be called a re-icing station all the way from California to Chicago. These early shipments were generally made by filling a car with small allotments from different places, but with the development of larger plantings regular shipping points were established so that small growers received the same advantage as large shippers, except in the matter of carload rates. Later, associations of growers removed this disadvantage ~~as~~ ~~law~~ from the small farmer.

A review of the different refrigerator car lines engaged in this early California business has been given in another place. Up to 1900 there were five competing car lines running to California, and hardly a year passed but what there were complaints on account of a shortage of cars ⁽¹⁾ at some time during the season, with consequent loss to the growers. The competition between these lines led to the payment of excessive rebates on the refrigeration charges to the largest shippers to induce them to use certain cars. This was eminently unfair to the small producers, and had a demoralizing

(1) Saturday Evening Post, March 10, 1906.

(2) Geo. B. Robbins in testimony before House Committee on Interstate Commerce, Feb. 13, 1905.

influence on the fruit shipping business. Furthermore, these competing lines were unable to give the most efficient service, because no one of them knew how much of the business it was going to get, and therefore did not know how many cars it would have to provide, nor how much ice to buy. In 1900, the Southern Pacific Railroad made an exclusive contract with the Armour Car Lines, whereby it promised to use nothing but Armour Cars, and in return for which the Car Lines promised to provide a sufficient number of refrigerator and ventilator cars to all shippers on equal terms. (1) Without discussing in this place the arguments for and against exclusive contracts, suffice it to say that the service since the making of this contract has been more efficient; there have been plenty of cars, and rebates have ceased. The season of 1906 perhaps offers an exception to this statement, in that there have been complaints from shippers that they have not been able to get enough cars, and railroad men in Chicago have expressed their opinion to the writer that this is probably due to the fact that the Harriman lines have recently ordered 6600 refrigerator cars which will supplant the Armour Lines, and that since this is the last season the private company can operate anyway, it is taking no pains to give adequate service.

There has been almost an equal division of this fruit traffic between the Southern Pacific and the Santa Fe Railways during the last few years, the former operating in the Northern part of California, and the latter in the Southern, with but comparatively little chance for competition. The rivalry has been very friendly where

(1) The terms of this agreement may be found in the testimony of Geo. B. Robbins before the Senate Committee on Interstate Commerce, May 16, 1905.

there ~~has~~ been competition, and neither road has attempted to any extent to invade the territory of the other. The relations between the Harriman interests and the Santa Fe, recently made public, may possibly explain this friendliness to a certain extent. The movement of oranges and lemons from California for the last few years ⁽¹⁾ has been as follows:

<u>Date</u>	<u>Carloads</u>
1894-95 - - - - -	5,575
189 5 -96 - - - - -	6,915
1896-97 - - - - -	7,350
1897-98 - - - - -	15,400
1898-99 - - - - -	10,875
1899-00 - - - - -	18,400
1900-01 - - - - -	24,900
1901-02 - - - - -	19,180
1902-03 - - - - -	23,871
1903-04 - - - - -	29,299
1904-05 - - - - -	31,422
1905-06 - - - - -	27,610

The thirty thousand carloads of fruit shipped during the season of 1904-05 amounted to over 10,000,000 boxes, valued in California at \$27,000,000. Figures furnished by the Santa Fe Refrigerator Despatch Company show the increasing amount shipped each year in its cars under refrigeration, as compared with merely ventilation:

(1) California Fruit Grower, Dec. 22, 1906.

<u>Year</u>	<u>Percentage under Refregeneration</u>
1897-98 - - - - -	22%
1898-99 - - - - -	17%
1899-00 - - - - -	28%
1900-01 - - - - -	47%
1901-02 - - - - -	33%
1902-03 - - - - -	48%
1903-04 - - - - -	40%
1904-05 - - - - -	51%

The reason for their being so many shipped under ventilation alone is that the citrus fruit shipments, which ^{we} are considering at present, are made almost entirely during the cold half of the year. The use of refrigeration is increasing, however, even in those months. The extent to which refrigeration is supplanting mere ventilation will be brought out more clearly later on in connection with the shipment of vegetables from California. Over 90% of the deciduous fruit, which is shipped during the summer months, goes in refrigerator cars under ice.

Before leaving California, it will be well to glance at the deciduous fruit industry. The development of this, although not so phenomenal as that of citrus fruit, has been very remarkable. In 1895 it amounted to 4568 carloads, in 1901 to 7,136 carloads and in 1905 to 8,224 carloads. ⁽¹⁾ For 1905 the shipment of deciduous fruits by varieties was as follows:

(1) California Fruit Grower, Dec. 22, 1906.

<u>Fruit</u>	<u>Carloads</u>
Apricots	279
Cherries	79
Grapes	1602
Peaches	1946
Pears	1013
Plums	1391
Various	<u>1914</u>
Total	8224

From the various figures given above, it will be seen that the fruit industry in California is still in its infancy; that it did not begin to assume any great importance until twenty or twenty-five years ago; and that in that time it has developed wonderfully. Its fruit now reaches every town of importance in the United States and Canada, as well as many European and other foreign markets. Furthermore, it ~~was taken~~ ~~can~~ can readily be seen that no such expansion of the business could have taken place without the refrigerator car.

Georgia is one of the most important peach growing sections of the country. In his annual report for 1875, Mr. Thos. P. James, Commissioner of Agriculture of Georgia, speaking of possibilities in fruit culture in that state, said: "By the twentieth of June, Georgia might place on the markets of the large cities of the North a million bushels of the most delicious peaches, and have virtually a monopoly of those markets for one month. With one half the labor and expense now bestowed upon the culture of cotton, which

sells at the cost of production, our farmers might secure millions of revenue from the sale of fruits." Thus was it realized what was possible if there were efficient means of getting fruit to market.

{1)

Georgia began raising peaches for local markets soon after the Civil War. In 1876 the present Georgia State Horticultural Society was organized, and at once became active in encouraging fruit culture, and in studying means to get the product to distant markets. In 1877, a few peaches were sent to New York by express, and one shipper received \$10 per bushel, which was about 16 cents for each peach. This fruit was picked ripe and packed in live moss. In 1879 refrigerator boxes, sent by express, brought fairly good returns. In 1880 peaches were shipped to Northern markets by freight for the first time by rail, in stock cars, to Savannah, and from there in the refrigerator compartments of the steamers of the Ocean Steamship Company to New York. It was not until 1882 that the railroads began to furnish refrigeration in transit. The Central Railroad of Georgia converted a few box cars into so-called refrigerator cars to run from the fruit district to Savannah. The only change in the construction was the placing of a trough-shaped wooden ice chamber longitudinally through the car, which was filled with ice, and the fruit loaded around it. The same year, the Austell Refrigerator car made its appearance. This was similar to the modern refrigerator cars, except that it had over-head ice chambers. For the next two or three years, the fruit crop was a failure on account of late frosts, but with the transportation problem solved the fruit acreage increased rapidly, and by 1889 the refrigerator

(1) A History of the Peach Industry in Georgia, compiled by the Central of Georgia Railroad.

car was in general use.

The history of the fruit industry in Georgia reveals a number of disastrous years when sometimes there was not a carload of peach-
ea shipped from the state on account of crop failures . In 1889, there had been over 150 cars of peaches shipped over the Central of Georgia Railroad, which handles the bulk of the fruit crop. In 1890 and 1891 were disastrous years; 1892 and 1893 good years with 250 cars the latter year; and by 1895 there were 743 cars handled. Some difficulty was experienced in procuring a sufficient number of refrigerator cars, and also in procuring ice for them. At this time there were five competing refrigerator car companies in the field. In 1898 the Central of Georgia, apparently with the consent of the growers, made an exclusive contract with the Armour Car Lines, and since then the peaches of Georgia have been handled only in Armour cars. In that year there were 1733 cars shipped, Since 1898 the crop has increased to about 5,000 cars per annum.

The peach district of Georgia which was originally confined to one county, has spread practically over the entire state. New orchards are being planted every year, and indications are that the industry is still in its infancy. Fruit lands have increased in value in some cases from as low as one dollar an acre to about \$300 an acre. It is easy to see from this review of the peach industry in Georgia, what a prominent part the refrigerator car has played.

The Michigan fruit belt, which extends north and south along the eastern coast of Lake Michigan, as an old district, and the fruit business there has not increased with leaps and bounds under

the ~~praxank~~ influence of the refrigerator car, as it has in other sections, which are situated further from important markets. For years the crop was dumped into Chicago and Milwaukee by steamer across the lake, with a resulting glut in these markets, and low prices. In fact, commission men in Chicago made handsome profits by reshipping the peaches to eastern markets, before the cars invaded the territory *itself*. The first attempts to handle Michigan peaches under refrigeration were made by ~~the~~ Mr. F. A. Thomas, the pioneer in the California business, in 1889. As a large part of the producing territory was not easily accessible to railroads, Mr. Thomas⁽¹⁾ leased for the season portions of the holds of two steamers plying between Saugatuck, Mich., and Chicago, a distance of about 90 miles. The compartments in these steamers were cooled, so that the fruit was in good condition when it reached the wharf in Chicago, where it was loaded into refrigerator cars, and then transported to distant markets. This rehandling was expensive, however, and injured the fruit, so that it has not since been attempted on a large scale.

As the Michigan district is so far north, and since the crop does not ripen until in September and October, there is not so much need ~~of~~ refrigeration as in the case of the districts lying farther south, and Mr. Robbins, President of the Armour Car Lines, made an estimate in 1905, that about one-third of the shipments from the state were made under ice. Prior to 1900, however, refrigeration was hardly used at all, and the more extensive use of refrigerator cars which have invaded the state in the last few years has brought important benefits to the growers. With the

(1) Taylor. Yearbook of Department of Agriculture, 1900, page 576.

refrigerator car came eastern buyers; the market was greatly extended, and prices rose; acreage increased; land values rose from less than \$25 per acre before development for peach growing, to \$250, \$300, and even more, with bearing peach orchards. Great quantities of fruit are still shipped to Chicago by Steamer from districts not accessible to the railroads, and prices there are consequently lower.

(1)
Mr. Armour, in his book on private cars, tells of the experience of representatives of eastern fruit houses who came to Michigan to buy. At the points served by private cars they found competing buyers, but discovered that great quantities were being sent to Chicago by steamer from places not served by the railroads. They forthwith went to Chicago, and bought Michigan peaches on the open market in South Water Street for shipment east, at lower prices than they would have had to pay over in Michigan at points served by refrigerator cars. This happened as late as 1904. Another instance is that of a grower of Shelby, Michigan, who shipped plums to two points, Chicago, Ill. and Dayton, Ohio. Those sent to Chicago brought 80 cents a bushel; those to Dayton, \$1.45 a bushel.

Armour cars have handled the bulk of the Michigan fruit, and deserve credit for having stimulated the business, by acquainting eastern buyers with conditions, and bringing them to the state where they buy direct of the grower. In 1902 Armour made an exclusive contract with the Pere Marquette, and for two years, handled all the traffic originating on that line. Complaints were made of exorbitant icing charges and the Interstate Commerce Commission, (2)
after an investigation XXX made in 1905, expressed the opinion that

(1) P. 98

(2) Interstate Commerce Commission Report for 1905, p.30.

certain charges were exorbitant. The Michigan Central also had an exclusive contract with Armour, but cancelled it at the time of the hearing. The Pere Marquette, although it operated for that season under its contract, made reductions in its refrigeration charges of from 15% to 30% and filed a statement with the Commission that for the season of 1906 it would purchase or lease equipment of its own. Before the 1906 season began, however, the Pere Marquette went into the hands of a receiver, who soon renewed the contract for another year. Hon. Judson Harmon was the receiver appointed by the Federal courts, and it is said that it was only after a careful investigation as to the attitude of growers along the line, that the exclusive contract was renewed.

Besides peaches, Michigan also raises large quantities of plums, strawberries, apples, pears, melons, and grapes, and is shipping an increasingly large number of these fruits to points outside the state. In 1900, there were 4,360 cars of peaches shipped and in 1904 the number had risen to about 8,000. This notable increase in the number of cars does not necessarily show a corresponding increase in the fruit industry of the state, but is rather an evidence of the more extensive use of refrigerator cars, as compared with shipments by steamer.

Thus we have traced the development of what may be called the three principal fruit-growing districts of the country, and have noticed the dependence of this development on the refrigerator car. Since the introduction of this means of transportation, however, and more especially within the last ten years, there have been other districts where fruit had never been grown to any extent, and which have now begun to come into prominence as fruit shipping centers.

The extent of this wholesale development of fruit lands, may be shown by giving a few more examples.

The cultivation of strawberries offers a good illustration of what has been done by efficient means of transportation. But a few years ago, the length of time that they were in the market at any one place was very short, as they are of an extremely perishable nature, and cannot safely be carried longer than twenty-four hours without being iced. The largest producing areas were those near the great markets, as in Maryland, Michigan, Ohio, and New York, and in 1899 these four states produced more than any others. With the perfection of the refrigerator car, however, strawberries began to move from the southern states at the time of ripening there, and are now commonly seen on the fruit-stands of the northern cities in mid-winter. This has led to the rapid development of strawberry plantings in certain sections of the South, the most important ones being in the Carolinas, Florida, Arkansas, Tennessee, and Missouri.

Strawberries were first shipped from Florida to New York under refrigeration in 1888, but this traffic never assumed much importance until within the last five or ten years. North Carolina is now the most important of these southern districts, and fifteen years ago the crop there was almost nothing. A few berries were shipped at first by express in refrigerator chests, and many continued to be shipped in this way even after the advent of refrigerator cars. Shipments by express and by ventilated cars have been superseded by the use of this more modern device, as illustrated by the following figures; traffic carried ⁽¹⁾ from North Carolina in refrigerator cars increased from 1897 to 1900, 152%, while that

(1) 12th Census of U.S. Vol. VI., P. 305.

carried by express companies increased only 31% and that forwarded by ventilator cars decreased 82%. As a net result of these changes, the proportion of the whole traffic carried in refrigerator cars in 1900 was 80.7% while in 1897 it was only 67%. Since then the proportion carried in refrigerator cars has increased still further, until now it is over 90%.

Fifteen years ago the shipments from North Carolina were unimportant, in 1897 they amounted to about 500 carloads and in 1904 to over 3000 carloads, and since the season lasts only a month, this meant 100 carloads a day. Chadbourn, N.C., did not ship a carload ten years ago, but is today the largest berry shipping point in the United States. The Atlantic Coast Line carries the bulk of this Carolina business, and since 1898 Armour cars have been operating over this road under an exclusive contract. During the early nineties, three or four other companies had been competing for the business, and the service was not reliable, and it was on the recommendation of the growers themselves that an exclusive contract was given to Armour. In 1905, shipments increased at one time to 200 cars a day, and there was a shortage of cars owing to poor handling of empties and freight blockades, with a consequent loss to the shippers, of thousands of dollars. As a result of this,
(1)
Armour settled claims for \$75,000.

Florida has, of course, derived great benefits from the development of modern transportation facilities, but this state has never fully recovered from the freeze of the later nineties, and has been overshadowed by California in the production of sub-tropical fruits.

(1) G. B. Robbins in testimony before Senate Committee on Interstate Commerce., May 15, 1905.

Florida has the advantage of being the farthest south, and consequently is able to take advantage of the high prices paid for the earliest shipments. This fact, together with the destruction of so many of the orange trees, has led to a diversification of crops, the principal of which are strawberries, grape fruit, peaches, and pineapples.

The railroads, through their industrial commissioners and their refrigerator car departments, have aided in developing certain sections along their lines and have advertised them by means of descriptive pamphlets which have been distributed broadcast. Texas, especially, is at present being advertised by the roads entering that state. Many out of the way places in the western state, where, a few years ago, it was never thought that it would pay to raise fruit on a large scale, are now sending carloads of perishable orchard produce to the eastern markets, with resulting prosperity among the farmers, and increasing land values. States that have been benefited in this way are Utah, Arizona, Idaho and Arkansas, (where the Ozark region deserves special mention for its apples and peaches),. The far Northwest now sends to market from 2000 to 3000 cars of fruit a year, and the northern routes across the continent have efficient refrigerator equipments of their own. The State of Washington, especially, is coming to the front in the raising of apples.

The transformation of industries brought about by modern methods of transportation, is nowhere more clearly evidenced than in vegetable gardening. Until the latter half of the last century, vegetables were grown within a short distance of the market for which they were ~~grown~~ intended, and could be supplied only during

the brief period when the several products were locally in season, except that small quantities were produced under glass. The location of the first truck farms was determined by proximity to water transportation facilities; thus one of the earliest centers for this business was along the shores of Chesapeake Bay, where fast sailing oyster boats were employed for sending the produce to the neighboring markets of Baltimore and Philadelphia. Likewise the gardeners around New York began pushing out along Long Island, using the waters of the Sound for transporting their produce. The trucking region on the eastern shore of Lake Michigan is another example of the effect of convenient water transportation in causing the early development of farming on a large scale.

From these centers, the industry gradually began to spread southward, *pari passu* with the development of transportation facilities. In the early fifties, the raising of vegetables for northern markets began around Norfolk, Virginia, and in 1854 the first cargo of 200 barrels of garden truck was carried from this port by steamer to New York. To secure proper ventilation it was necessary that these should be carried on deck so only a small load was possible until efficient means of ventilation were devised. The first all-rail shipment from Norfolk to New York was in 1885, and with the use of the ventilator car, and later the refrigerator car, the area of production began to extend rapidly southward and westward. Charleston and Savannah soon became centers of important trucking regions, and then came the whole state of Florida. The development in this state has been very recent; from one section which raises lettuce, celery, peas, beans, and cucumbers, the shipments increased from 100 cars about 1898 to over 800 cars in

(1)
1904. Extending northward and westward from Florida are the watermelon region of Georgia, and the trucking districts around Mobile and New Orleans. Texas is now being developed and this state, on account of its remarkable soil and climate, gives promise of becoming one of the greatest, if not the greatest, vegetable growing state in the country.

A development analogous to this has also taken place from the districts around Chicago as a center. With the building of the Illinois Central, the region in Southern Illinois was first opened up. From this point the business has gradually extended to Tennessee, Missouri, Mississippi, and Arkansas. About seven or eight years ago fifty cars of tomatoes were shipped from Humboldt, Tennessee during a season. These had to be shipped green, and ripened in the commission man's store room, thereby impairing the quality. This point now ships over 500 cars a season, the tomatoes are allowed to ripen on the vines, and therefore bring much better

(2)
prices. Crystal Springs, Mississippi, has long been the greatest tomato-shipping point in the world. The industry began there about 1875, and in 1885 it was shipping from five to eight cars a day. In 1895 the number had increased to between forty and fifty cars a day.

The extension of truck-growing districts has also spread to the west and even as far as California. Shipments of vegetables from this state for the past few years have been as follows:

- (1) Testimony of T. B. Felder before House Committee on Interstate Commerce, Feb. 16, 1905.
- (2) Armour, P. 93.

<u>Year</u>	<u>Cars</u>	<u>Percentage of total carried by Santa Fe under refriger- ation.</u>
1897-98	738	18%
1898-99	870	25%
1899-00	1530	50%
1900-01	1918	69%
1901-02	2181	67%
1902-03	2076	72%
1903-04	2230	84%
1904-05	2263	90%

The last column of figures shows to what an extent shipment under refrigeration has supplanted that under ventilation, and that practically the entire crop is now carried under ice. Other sections west of the Mississippi have also sprung up, such as the Ozark Mountain region in Arkansas, certain districts in Iowa, and Kansas, and the irrigated territory of the Arkansas Valley in the western part of Colorado, where the famous Rockyford cantaloupe region is located. The development of this region illustrates so well the influence of refrigerator cars, that a short review of its history is instructive.

The Rockyford cantaloupe was first grown for market at Rockyford, in the southeastern part of Colorado, in the year 1885, and for years it was raised on a small scale and sent only as far as Denver, Pueblo, and other cities within easy reach. In 1894 the growers co-operated and shipped for the first time in carload lots. Transportation facilities were not adequate for the handling of the crop, and the adjacent markets were flooded with melons, with conse -

quent loss to the farmers. It was not until 1897 that shipments were made as far east as New York, by means of the refrigerator car. This expansion of the market was immediately attended by an increase of the business, and the Rockyford soon became famous in the eastern markets for its thick flesh and delicious flavor. In 1897 there were 121 cars shipped from the Rockyford district; in 1904 the number had increased to 1,182. In the same time land values had increased from five dollars to \$100 and \$150 per acre.

Prior to 1897, the high prices and limited supply made the cantaloupe a great luxury, and it was too expensive for the ordinary grocer to handle. New York had been supplied for years with an inferior melon, mainly from Maryland, Delaware and New Jersey, and the season lasted but a few weeks. When the superior qualities of the Rockyford became known, other districts all over the country began to raise it - principally Florida, Georgia, the Carolinas, Texas, and California. The result of this expansion of the growing area is that New York is now supplied with melons from early in May until late in October. The earliest shipments come from Florida, and then from districts further and further north as the season advances. The cantaloupe is a highly perishable commodity and required careful handling and supervision in transportation, and is, perhaps, one of the most striking examples of the wholesale change that has been wrought by the refrigerator car on our agricultural development. In 1897 the amount consumed in the United States was not over 400 carloads. This amount gradually increased until during the year 1905, 6,920 carloads were used throughout the country, and the season for cantaloups has changed from a period of less than two months to six months of carload business. (1)

(1) Development of the Rockyford Cantaloupe Industry, by P.K.Blinn. Bulletin 108, Colorado Agr. Experiment Station.

The consumption of those vegetables which are the most perishable has shown the greatest increase under the influence of refrigeration in transit. For instance, not more than seven or eight years ago, one car a day of head-lettuce was sufficient to supply the New ^{York} Market.. Today, New York alone uses forty to fifty cars a day during the winter months. Many vegetables of this nature were formerly raised under glass, near the large cities at great expense, so as to take advantage of the fancy prices that could be obtained early in the season. The competition of southern districts, however, has forced many of these hot-house cultivators out of business. Celery, Cauliflower, asparagus, and cabbages, are shipped to a great extent in refrigerator cars. The Illinois Central long ago earned the sobriquet of "the cabbage route" from the fact that it was moving trainloads of cabbages north daily during spring and early summer, and equally large quantities south during fall and winter. The need of refrigeration for asparagus is illustrated by an occurrence that happened recently in Chicago. A car came to that city loaded with asparagus, and through some mistake no ice had been placed in the bunkers. As asparagus is packed in damp moss, it was found on opening the car that the asparagus stalks had grown a foot, and were unfit for market. The principal celery growing district of the country has always been around Jackson, Michigan. Now Celery is grown in California and some of the southern states. In 1904 an island in the San Joaquin River in California began to raise celery for eastern markets. In that year it shipped eight carloads, in 1905, forty carloads, and in 1906 400 carloads, at a profit of seventy-five dollars an acre. Not one pound of this could be shipped if it were not for refrigerator cars.

In the shipment of the more hardy vegetables, refrigerator cars are used perhaps even more in winter than in summer, in order to keep them from freezing. Potatoes, for instance, are being shipped in this way more and more every year. Vegetables grown for export are more apt to be sent under refrigeration than those destined for domestic markets. In fact the demand for refrigerator cars for the shipment of vegetables of all kinds is increasing rapidly, and judging from the comparatively recent origin of this business, and its growth during the last few years, it may be considered as still in the early stages of its development, with prospects of a still greater expansion in the future.

Another important class of commodities whose transportation over great distances is largely dependent on refrigerating facilities is that of dairy products, which include principally butter, cheese, eggs, milk, and dressed poultry. In fact, the refrigerator cars operated by the Pennsylvania Railroad, numbering about 3500, are used almost entirely for this business. Their ice capacity is not so great as that of the ordinary Fruit car, and at certain times of the year, when fruit shipments originate along the Pennsylvania Lines, especially in Delaware, the traffic has been handled in (1) The Armour cars, although not under an exclusive contract. cars of the Merchant's Despatch Transportation Company, the line operating over the New York Central Lines, are also intended primarily for this kind of traffic. The growth of dairy farming in Wisconsin, Iowa, and Nebraska, as well as other western states, has been due in a great measure to these superior facilities for getting goods to eastern markets.

A single illustration of this development will suffice. Ex-

(1) Twenty-eighth Annual Report of the Wisconsin Dairymen's Association, 1900.

(1) Armour. P. 269.

Governor W. D. Hoard of Wisconsin, speaking before the Wisconsin Dairy⁽¹⁾men's Association in 1900, told of the early history of the industry in that state. In 1873 there were about a million dollars worth of dairy products in the state; somewhere in the neighborhood of forty cheese factories struggling in a feeble way; no creameries, and few private dairies. It was costing two cents and a half a pound to ship cheese to New York City in ordinary box cars, and the channels of commerce were blocked to Wisconsin dairy-men, as they had to send their products to Chicago, and then have them reshipped to eastern markets. About that time Mr. Hoard interviewed Mr. W. W. Chandler, the originator of refrigerator cars on the Pennsylvania Railroad, to whom we have referred above, on account of the prominent part he played in the early development of these cars, and induced him to send some of his refrigerator cars to Wisconsin. Mr. Chandler himself went to the principal shipping points, and explained to the dairymen the whole system of refrigeration, as it was understood in those early days, and offered a rate of one cent a pound in iced cars to New York City. The business immediately began to grow. In 1876, at the Centennial, Wisconsin men took the first premium on their cheese. By 1890, many farmers had turned their attention from wheat farming to dairy farming, and the state was sending large quantities of butter and cheese to the Atlantic Seaboard, some to be used there, and some to be sent to England. In 1900, it was estimated that the dairy products of the state had an annual value of \$35,000,000, and land values had increased from eighteen dollars to between sixty and eighty dollars an acre.

(1) Twenty-eighth Annual Report of the Wisconsin Dairy~~men's Association~~, 1900.

We have now reviewed some of the more important phases of our agricultural development, which have been dependent on the refrigerator car. It is also interesting to notice the effect of this development on prices of agricultural produce. Statistics on the prices of fruits and vegetables are meagre for two reasons: first, because a national market has but recently supplanted local markets for these goods, and second, because there has been so much irregularity in the size of packages that uniform price quotations in the majority of cases have been next to impossible. Although the size of packages still varies to some extent in different parts of the country, yet there has been much progress in attaining uniformity for the most important products. Furthermore, price statistics over a series of years would tell but little in the case of fruit, especially, because the drop varies to such an extent with climatic conditions that the fluctuations in prices from year to year are enormous.

Some general tendencies in the prices of fruits and vegetables may be noticed, however, as a result of improved transportation facilities, and these are; first, a greater stability of price in any particular market; second, a general levelling of prices throughout the whole country; and third, a general raising of prices for the growers, situated at a distance from the large markets.

As for a greater stability of prices over a more extended time, it is well known that the price of a perishable commodity is high when it first makes its appearance in the market and that it gradually fall, sometimes to a very low level at the height of the season, and then rises again as the season wanes. Before the advent of refrigerator cars, these fluctuations in prices were much more extreme than they are now, and covered a shorter period. Any par-

ticular market could be supplied with such an article only at the time of year that it ripened in the vicinity of that market. For instance, take strawberries, in the City of New York. The first berries that reached the city were either those raised under glass, or sent from Delaware or New Jersey by express at great cost, and these naturally obtained fancy prices paid by the wealthier classes. When the berries began to ripen locally and on Long Island, the price fell rapidly, and often reached a point so low as to be unremunerative to the growers and the season came to an end abruptly with the last of the locally-grown berries, having lasted approximately six weeks. With the use of the ventilator car, the area of production was extended slightly and berries began to arrive a little earlier. Then came the refrigerator car, and the consequent development ~~that~~ of the vast strawberry fields of the Carolinas, Georgia, and Florida. Berries now begin to arrive in mid-winter from Florida. The first ~~seasons when to command the prices fall~~ ones command a high price to be sure, but by the end of the winter months the price falls to a point within reach of large classes of people, and remains comparatively stable until the berries ripen locally. After these have passed, small quantities of berries continue to find their way to market from more northern sections, and the price gradually rises again. Thus the season for strawberries has been increased from about six weeks to over six months, with the prices fairly uniform a large part of the time, and within reach of all but the poorest classes. It is evident that this result has been brought about through the extension of the producing area, which in turn, has been made possible by the refrigerator car.

On the other hand, the second tendency, that of the levelling of

prices of perishable stuff throughout the whole country, is due to the extension of the market area. When each fruit growing district for example, was dependent on the nearest city for its market, the market was very limited, and there was no relation between the different markets of the country. For instance, Chicago might be flooded with peaches, at very low prices, while at the same time, Boston might have but few peaches at high prices.

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Prof. Marshall in discussing markets, and their effect on the equilibrium of demand and supply, divides commodities into two classes, - those having a national and even international market, such as securities of corporations, and the precious metals, and those having but a limited market, such as perishable and bulky goods. He says, "There are indeed wholesale markets for the second class, but they are confined within narrow boundaries; we may find our typical instance in the sale of the commoner kinds of vegetables in a country town." When Marshall wrote, , vegetables undoubtedly were a good example of this, but within the last few years the vegetable market has extended to such an extent, especially in the United States, that the illustration has lost a good deal of its former significance. Today the market in this country for Vegetables and fruits, is almost a national one, and may even be called an international one, and the different sections of the country are in such close contact, that there is a general equalization of the supply according to the demand, and consequently a fairly uniform price_xlevel throughout the country. Of course the adjustment is not by any means perfect, but by constantly studying

the markets, growers ship their products to that point offering the largest return. Often times prices fluctuate, and a market becomes glutted while a shipment is in transit. The shipper can then telegraph ahead to some junction point, and have his car diverted to some other point, ~~and~~ Armour says that in 1904, during the month of July, more than 500 cars of Georgia peaches were caught at Cincinnati alone, ⁽¹⁾ diverted from their original destination, and sent to other places where the prices were higher. In this way, markets react on each other, and by the control that the grower has over the destination of his products, there is this general levelling of prices throughout the whole country.

The third principal effect on prices, that of the raising of prices for the growers, is evident in a great many instances. There are some minor exceptions to this tendency, such as the case of growing under glass in northern climes for the sake of taking advantage of the high prices at the beginning of the local season, and in some instances, as we have seen before, such producers have been forced out of business by the competition of products brought in refrigerator cars from warmer sections, where they have been allowed to ripen naturally. The raising of prices for Michigan peach growers has already been alluded to. When the crop used to be dumped in Chicago and Milwaukee by means of steamers across Lake Michigan, those markets invariably became glutted, and prices were exceedingly low, often resulting in a loss to the shippers. The same thing is illustrated in the history of the cantaloupe industry in eastern Colorado. When only the local markets of Denver, Pueblo, etc., were open to producers, the prices were often so low that the season

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resulted in a loss, and it was not until 1897, when the market was extended to the east of St. Louis, that the cultivation of melons was rewarded by adequate returns. Likewise, in California, the carriage of fruit to eastern markets was obstructed at one time during the season of 1894, the San Francisco market became flooded, and prices were slaughtered, but with the resumption of eastern business, they recovered again. Examples of this effect might be multiplied indefinitely, especially in the case of sections far removed from markets, where a few years ago it did not pay to produce on a large scale, and where the increases in land values bear eloquent testimony of the improved condition of the farmers.

We have now completed our survey of the history of special equipment cars, and the part ~~ahat~~ they have played in the development of the country. As intimated in our introduction, the second part has been studied almost exclusively in connection with the refrigerator car, ~~And~~ although there are other phases of the development which might have been discussed, yet enough has been said to show the important role that this modern device of transportation has played in building up certain agricultural sections of the country, and it has been the purpose of this sketch to impress the reader with the importance of this factor at a time when private cars in general are being discredited by a large majority of the public, who realize but little the great benefit that they, together with the cars owned by the railroads, have been to the country at large.

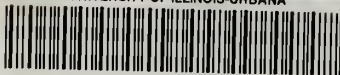
The consideration of this subject of special equipment cars was originally suggested by the controversy that has been waged

in respect to privately owned cars, during the last few years, and all that has been said has been in the nature of a preparation for a complete and comprehensive study of the relations of these cars to the railroads. It is my purpose, ultimately to trace the history of this relation, to study the practices of the car lines, to reveal the evils in connection with their use, and to suggest remedies for the same.





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